

## Before the Quake

### FAULT ZONE REPORT RELEASED

Two days before the earthquake that rocked northern Utah and southern Idaho (see this issue, "Quake Musters UGMS"), a special earthquake study—*Investigation and Evaluation of the Wasatch Fault and Cache Valley Faults*—was presented to officials of Box Elder and Cache counties in Brigham City and Logan and to the Logan City Commission.

The U.S. Geological Survey produced this study on the active fault zones in northern Utah and asked the Utah Geological and Mineral Survey to distribute it. Two previous reports on the Wasatch fault zone were sponsored and released by UGMS. This third report, covering the Wasatch fault in Box Elder County and southern Idaho and the Cache Valley fault in Cache County and southern Idaho, contains maps and photographs that show the traces of ground breaks from past earthquake activity.

Bruce N. Kaliser, chief of UGMS' Urban and Engineering Geology Section, presented the report in meetings and workshops with county and city officials on March 25. He briefed officials on the extent of earthquake activity in northern Utah. He emphasized the need for proper land-use planning that could help reduce the risk to life and property in earthquake zones. In the workshops, Kaliser instructed those who would use the report to judiciously consider an area's earthquake faults and other geologic hazards before planning either a public or private facility. He asked that sites for facilities that must remain useful in an emergency—such as hospitals, communication centers, water treatment plants,

(continued on page 5)

## Neither rain, snow, sleet, nor quake ...

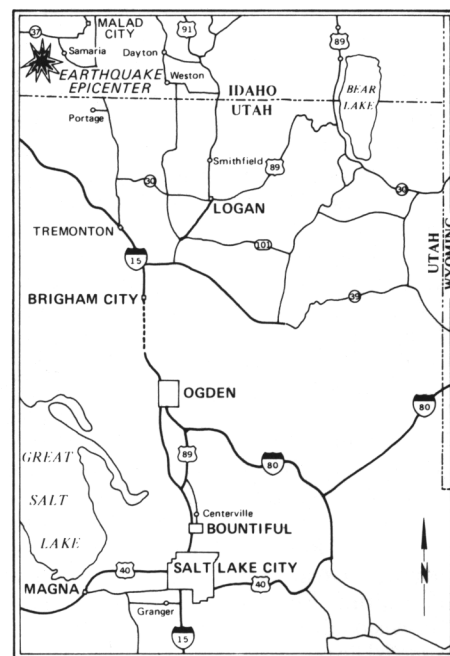
### QUAKE MUSTERS UGMS

The Utah Geological and Mineral Survey responded quickly to the 6.3 magnitude earthquake near the Utah-Idaho state line on Thursday, March 27, at 8:32 p.m.

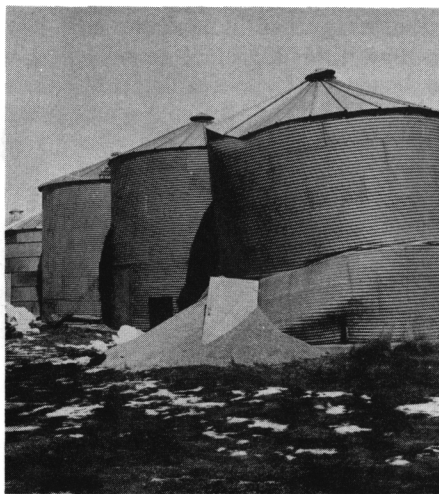
Bruce N. Kaliser, chief of UGMS' Urban and Engineering Geology Section, reported immediately to his office that night to attend to UGMS' responsibilities dealing with state emergencies. The State Office of Emergency Services provided Kaliser with results of the statewide and interstate radio contacts.

Friday morning, Kaliser and Mohammed Raja, also of UGMS, headed for the epicentral region in the Pocatello Valley. In the company of Ed Yeates, KSL news, and Earl Fuhrman, a local resident, the UGMS geologists were the

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Scale: 1 inch approximately 17.4 Miles



Left: Storage bin spilling barley. Note severe buckling and shifting on concrete foundation, an indication of intense ground shaking. Evidence for both vertical (1 inch) and horizontal (2½ inches) ground motion was observed. (UGMS photo) Top Right: Epicenter located in southern Idaho. Bottom Right: Cracks in front of Sumner School, Salt Lake City. Some bricks were displaced higher on the wall. (UGMS photo)

## Survey Releases Latest Studies

by Carlton H. Stowe  
UGMS Information Specialist

The Utah Geological and Mineral Survey has released its latest publications through the UGMS Publication Sales Office, 103 UGS Building, University of Utah, Salt Lake City, Utah 84112. When ordering by mail, add 10% for handling and mailing charges.

**Utah Geology, Vol. 2, No. 1, Spring, 1975.** This is the second issue of the Survey's new journal, published biannually. Subscriptions are \$6.00 per year. Each issue is \$3.50. Reprints of any article are \$1.50 each. This issue includes papers on the "Paleocurrent Analysis and Orientation of Sandstone Bodies in the Duchesne River Formation (Eocene-Oligocene?), Northern Uinta Basin, Northeastern Utah" by M. Dane Picard and David W. Andersen; "Reconnaissance Study of the Stateline Mining District, Iron County, Utah" by Kenneth C. Thomson and Lee I. Perry; "Mid-Tertiary Volcanic Stratigraphy, Sevier-Cove Fort Area, Central Utah" by Charles F. Caskey and Ralph T. Shuey; "The Chinese Wax Mine: A Unique Oil-Impregnated Rock Deposit" by Howard R. Ritzma; "Primary and Secondary Sedimentary Structures in Oil Shale and Other Fine-grained rocks, Green River Formation (Eocene), Utah and Colorado" by Rex D. Cole and M. Dane Picard; "Great Salt Lake—An Overview of a Brine Resource" by J. A. Whelan; "Provisional Rb/Sr Age of the Precambrian Uinta Mountain Group, Northeastern Utah" by M. D. Crittenden, Jr. and Z. E. Peterman; "Largest Known Landslide of Its Type in the United States—A Failure by Lateral Spreading in Davis County, Utah" by Richard Van Horn; and "Earthquake Epicenters, January-June 1974" by Kenneth L. Cook and Frank J. Hamtak.

**Bulletin 106, Utah Mineral Industry Statistics Through 1973,** compiled by Carlton H. Stowe (\$3.50). This publication presents Utah's mineral industry statistics from first recorded production. The Utah Mining Association compiled major portions of statistical information from 1950 to 1970 on Utah's mineral industry. Data were collected from several sources, but the U. S. Bureau of Mines information was most often utilized. Bulletin 106 includes 82 tables on the mineral industries' production, value,

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## AT HOME WITH GEOLOGY

### Citizens Assist UGMS Programs

by Bruce N. Kaliser  
UGMS Engineering Geologist

*Determine and investigate areas of geologic and topographic hazards that could affect the safety of, or cause economic loss to the citizens of Utah (Utah Code annotated: 53-36-6). That's one charge of UGMS that is not taken lightly in the daily establishment of priorities by the agency. Also of relevance to the agency's Urban and Engineering Geology Section are the state directives, to assist and advise state and local government agencies and state educational institutions on geologic subjects . . . and to cooperate with state agencies, political subdivisions of the state, quasi-governmental and federal agencies, schools of higher education, and others in the fields of mutual concern including field investigations and preparation, publication, and distribution of reports, maps, and publications embodying the results of the work.*

Citizens can and do provide input into UGMS programs affecting them. On occasion they bring hazardous situations to the attention of the state geologist. Frequently citizen cooperation is required to acquire historical data and other facts relative to field investigations. The questionnaires published in Utah newspapers following felt earthquakes are

a case in point. The return of these published forms greatly facilitates UGMS's evaluation of ground motion in a defined geographic area. From these responses it may be possible to assess the potential hazard from more severe groundshaking in the future. Ultimately the information learned by UGMS is given to elected officials and city and county engineers, planners, building inspectors, and the like for the public's welfare. Where necessary UGMS has worked directly with citizens' groups in addressing their mutual concerns.

Knowledge of ground cracks, ground subsidence, landsliding, mud flows, and other earth disturbances conveyed to UGMS is retained for future evaluation if it doesn't require immediate action. Contributions of photographs of any vintage showing these same features are very much appreciated, particularly when thorough documentation accompanies them.

The citizens of Utah can assist UGMS in its role of determining where suitable terrain exists for housing as well as for other facilities so that together we can finally be "at home with geology."



### 1934 versus 1975

Left: Photo taken in 1934 immediately after the Hansel Valley earthquake in northern Utah. Note resemblance to the hole in Tremonton. (Photo by George Bateman)  
Right: Nine-foot diameter hole in Tremonton, Utah, following a quake aftershock of magnitude 4.0. (UGMS photo)





# NEW OIL PROVINCE?

## PINEVIEW OIL DISCOVERY

by Carlton H. Stowe  
UGMS Information Specialist

A Nugget Sandstone discovery 12 miles east of Coalville near Pineview, Summit County, has accelerated oil exploration along the northern flank of the Uinta uplift in the southwestern reaches of the Green River Basin. Not since the Bridger Lake oil field discovery, some 40 miles east in 1966, has this lightly drilled area of the mountain states attracted more nationwide attention.

American Quasar Petroleum, Energetics Inc., and North Central Oil drilled the discovery well, #1 Newton Sheep Co., NE SE, Sec. 4, T. 2 N., R. 7 E. It was completed January 12, 1975, flowing 540 barrels of oil, 226 barrels of water, and 270,000 cubic feet of gas per day. An eight-foot interval in the Nugget that is perforated at 9,928-9,936 feet is producing. American Quasar reports total cost of

the discovery well to be over \$2.5 million.

The Pineview discovery was drilled on the Chalk Creek anticline, one of several complex folds located near the junction of three major structural features: the Wasatch Mountains, the Uinta Mountains, and the Idaho-Wyoming Thrust Belt. To the west is the Coalville anticline, site of a gas storage project operated by Mountain Fuel Supply Company.

The Chalk Creek anticline is an asymmetric, complexly faulted fold that trends northeast to southwest. The folding and faulting are related to the Idaho-Wyoming Thrust Belt which is exposed along the flanks of the Uinta Arch and the Wasatch Mountains where thousands of feet of Paleozoic and Mesozoic sedimentary formations represent a transition from miogeosynclinal sedimentation to shelf-type deposits. The section ranges in age from Cambrian to late Cretaceous and early Tertiary.

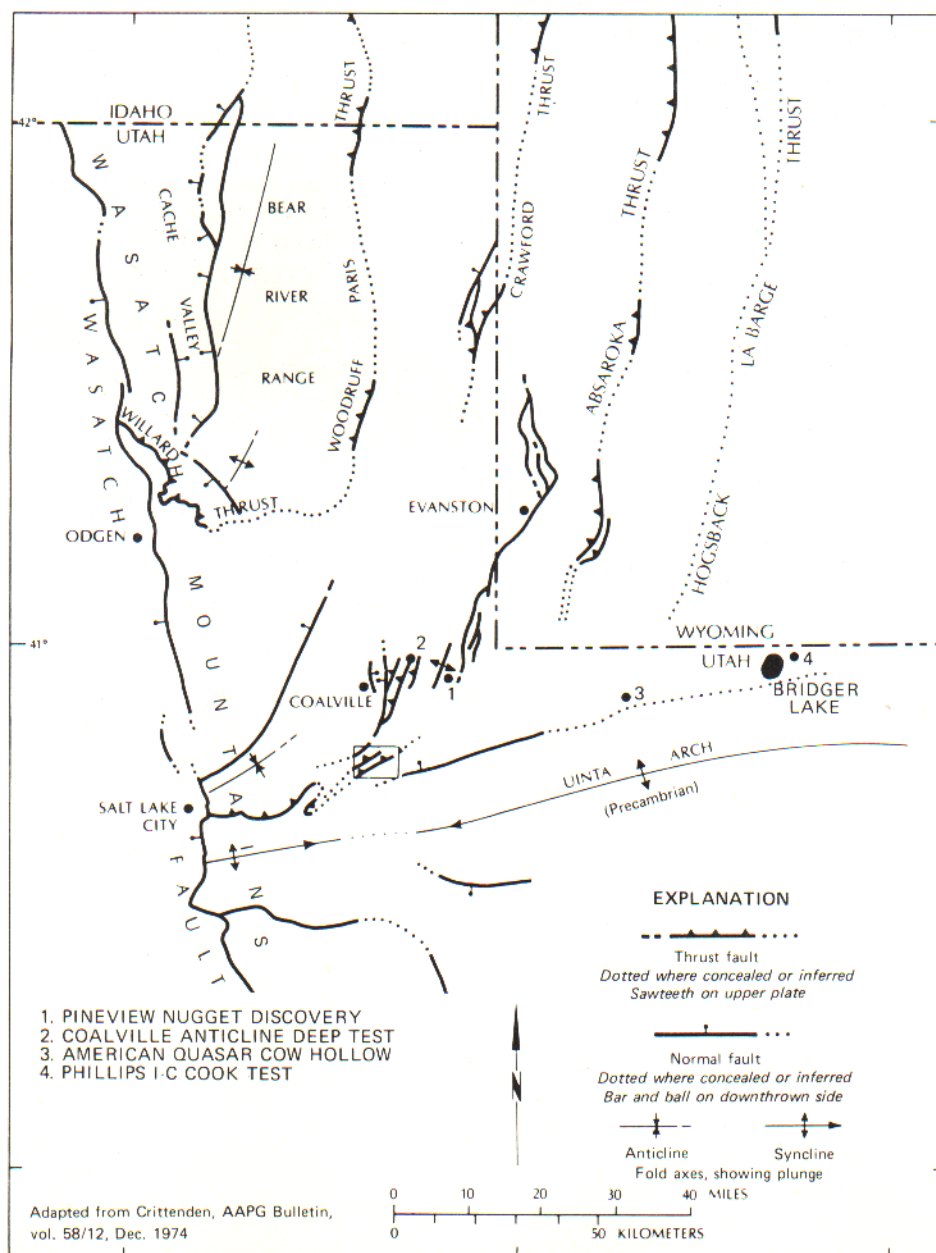
The discovery well revealed unsuspected thicknesses of Jurassic Nugget Sandstone. Some 133 feet of Nugget Formation oil pay sand was logged. From a ground elevation of 6,536 feet (6,555 feet KB) in alluvium just south of Chalk Creek, the well penetrated the following section:

Formation	Top (feet)	Thickness (feet)
Knight Conglomerate (Tertiary)	Surface	1,500 ±
Mowry-Aspen (Lower Cretaceous)	1,500	2,200
Kelvin (Lower Cretaceous)	3,700	2,500
Morrison (Jurassic)	6,200	400
Stump	6,600	400
Pruess	7,000	1,770
Twin Creek Limestone	8,770	910
Gypsum Springs	9,680	140
Nugget	9,820	?
Total depth	14,500	

The well was drilled on a geophysical anomaly indicating structural closure. Below the Nugget, the well cut a fault in Triassic redbeds and bottomed in Cretaceous.

The Board of Oil and Gas Conservation, Utah Department of Natural Resources, held a public hearing in March on American Quasar Petroleum's request

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Location of Pineview Nugget discovery and other tests.

## CACHE VALLEY

# Water Well Erupts Gas and Mud

by Howard R. Ritzma  
Assistant Director, UGMS

A water well being drilled for a new home in a rural area three miles west of Richmond, Cache County, blew out on Thursday, February 27, and began to flow gas in a spray of muddy water and occasional mud clods, pebbles, and small cobbles. The flow of gas continued unabated until mid-March when a more erratic flow was observed. After nearly dying several times the well burst into activity again in late March at which time a small crater developed around the casing at the surface. The casing slowly settled into the crater but remained protruding above ground. Then the gas flow ceased, ending a local source of curiosity and fear and a giant-size headache for the home owner whose large, nearly finished frame home stood only 19 feet away.

Shows of gas in water wells in Cache Valley are not unusual, and the thick alluvium and late Tertiary Salt Lake Formation beds filling the valley have been occasionally prospected as a local source of gas for fuel. The well in question flowed from a depth of 186 feet from what may have been a coarse sandstone or conglomerate marking the base of the alluvium and the top of the Salt Lake Formation. The presence of nearby deeper water wells that did not encounter gas appears to rule out the possibility of a reservoir of large areal extent. The unusual volume of gas and the strong pressure encountered suggests that the gas may have migrated from a greater depth through a fault or fracture.

The flow rate was guessed to range into several million cubic feet per day with hundreds of pounds pressure, but experienced estimators placed the initial

flow at a 250 thousand cubic foot rate with a pressure less than 50 psi. Because of the spray of muddy water accompanying the gas, the flow rate could not be gauged accurately without installation of a separator or treater. This was never done. However, the well did make an impressive display, and its roar could be heard for nearly half a mile across the valley floor.

The question was frequently asked: was this "marsh gas" or natural gas? The boundary between the two is poorly defined. An analysis of the gas showed it to be 94.32 percent methane with small quantities of CO<sub>2</sub>, nitrogen and oxygen, a composition suggestive of "marsh gas." Most combustible natural gases are largely methane, some almost 100 percent; but constituents such as ethane, propane, and butane usually are part of the mixture. In this case, these were not present. Methane is flammable and has a BTU heating value of 1003 per cubic foot. Gas from the Cache Valley well rated 957 BTU per cubic foot and was certainly a potential fuel. However, the spray of water produced with the gas diminished the possibility of ignition and the danger of explosion and fire.

At present the well is dormant, and the Utah Division of Oil and Gas Conservation has taken precautionary plugging measures. Plans are under way by local interests to drill wells nearby to develop the shallow gas reservoir.

To most persons, a gas well in the backyard might be a considerable asset or blessing—but probably not if one has just built an all-electric home as was the case here.

## WESTERN MINING CONFERENCE

More than 3,000 people attended the National Western Mining Conference and Exhibition held in Denver, Colorado, this February. Conference sessions dealt with energy problems, metals used in construction, economics, oil-shale development, new exploratory techniques, and the legislative impact on the mining industry.

Carlton Stowe, UGMS staff specialist, maintained the Utah natural resources' exhibit, which displayed the maps and publications of the Survey. Mr. Stowe noted a rising interest among mining associates in the energy resource possibilities of Utah. In particular, he assisted several exploratory, engineering, and geological consulting firms in their evaluation of Utah's resource potential.

## Oil Seep in Strawberry River

by Jock A. Campbell  
Chief of Petroleum Section

*What is it?* A rock hammer lying on a Jackson Pollock canvas?



No, this is a photo of a Uinta Basin oil seep, just the type of occurrence that has ultimately led wildcatters, speculators, investors, and geologists to the world's major petroleum deposits.

The seep occurs about nine miles west of Duchesne, in NW NW, Sec. 10, T. 4 S., R. 6 W., Ute Meridian. The seep is unusual in that it does not occur at an observed fault, nor are there any oil-impregnated rocks in the vicinity. Rather, the petroleum has found its way upward through an unknown thickness of silt and clay deposits of the Strawberry River. The tarry oil then flows into the river at several places along a distance of several tens of feet.

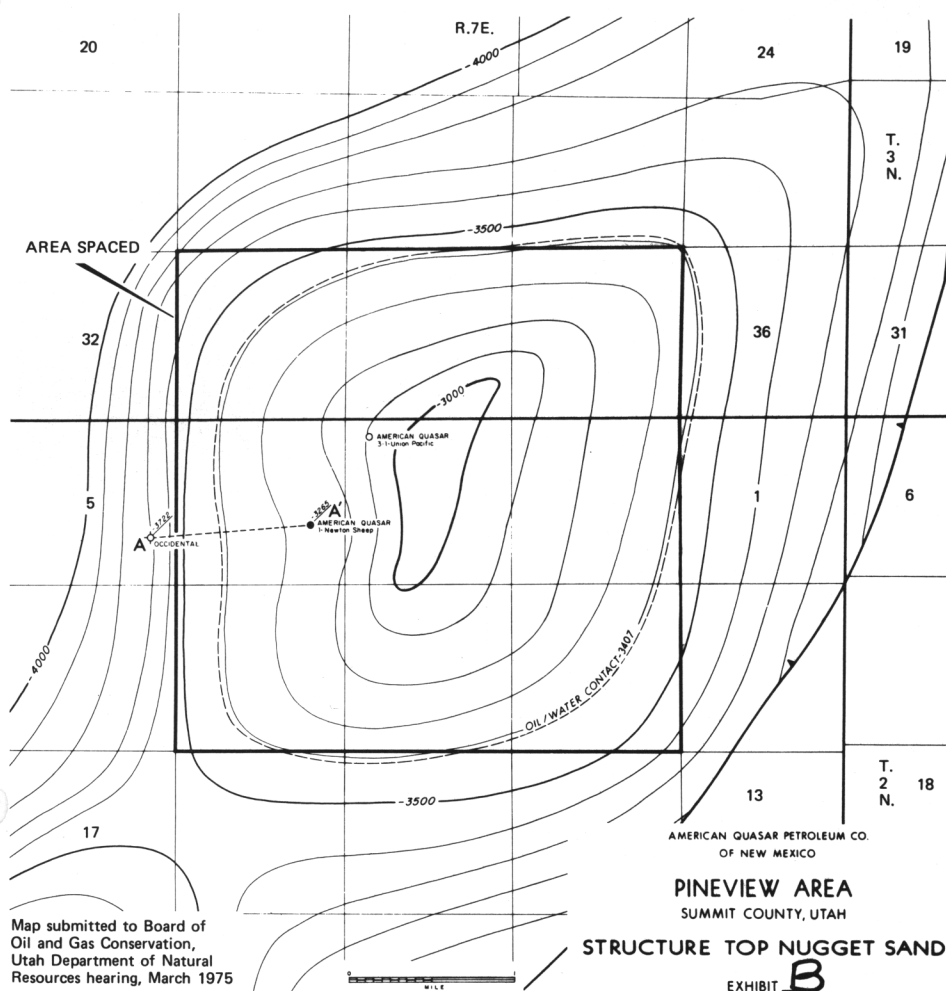
This seep and some now inactive sulfur springs less than a mile away were mapped by a geologist in 1921. A local rancher remembers the seep from his boyhood. It seems, then, to have been active throughout at least the past fifty-plus years.

Commercial oil production in the vicinity has occurred since 1966 with the discovery of Indian Ridge field, about four miles to the east. More recently, oil production has been established in the area and continues at Starvation field. In 1969, the Cedar Rim field to the north was discovered; drilling in that field has proceeded southeasterly so that the closest well is just 3½ miles northwest of the seep. Subsurface pressure reduction coincident with the areas' oil production has not stopped the seep, although there is no measure of whether the flow has diminished. However, one wonders if the seep is related to an as-yet undiscovered reservoir of petroleum.



## PINEVIEW

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American Quasar Petroleum Co.'s drilling and spacing patterns for development of the Nugget.

for an order establishing 160-acre drilling and spacing patterns for the development of the Nugget. In the immediate area, the Board approved the 160-acre drilling request for one year, or until five wells are completed and are producing.

American Quasar expects to recover 1,522,000 barrels of oil for each 160-acre well. The estimated ultimate gas recovery is indicated at 1,217,600 MCF with an estimated liquid recovery from the gas at 3,652,800 gallons.

Leasehold ownership in the nine-spaced sections is held by Amoco Production with 50 percent, Sun Oil 25 percent, and Occidental Petroleum 25 percent.

To the northeast an intended confirmation well is being drilled jointly by American Quasar, Energetics Inc., and North Central Oil at the #3-1 Union Pacific, NW NW, Sec. 3, T. 2 N., R. 7 E. This offset test is scheduled to 10,000 feet in the Nugget. Three wildcat tests are also being drilled in the vicinity. These are: a deep test of Coalville anticline by Colorado Energetics and Fuelco; American Quasar No. 1 Cow Hollow, 24 miles east of the discovery; and a test, possibly to 20,000 feet, now being drilled by Phillips northeast of the Bridger Lake oil field.

The Nugget discovery in the Pineview area sparked new oil and gas leasing in northern Utah northward through Morgan, Weber, Cache, and Rich counties as far as the Idaho state line. More than 60,000 acres of state and federal lands were initially filed on by Denver independents in late December 1974. More than a quarter of a million acres of federal land in the general area was covered by lease filings in early 1974. Steady leasing has been undertaken to the west of Pineview, throughout the Coalville vicinity and extending both to the north and south.

Utah's newest oil province may be in the making.

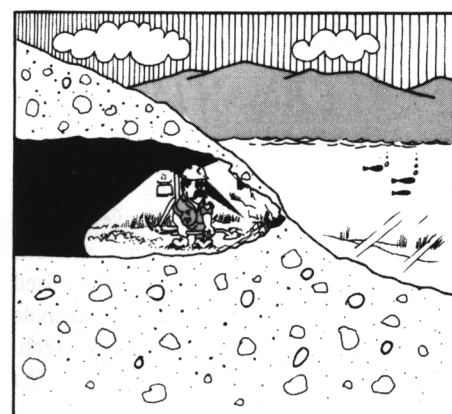
## FAULT ZONE REPORT

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and ambulance garages—be given a thorough geologic evaluation before the site is chosen.

Interested persons will find the report available at most public libraries.

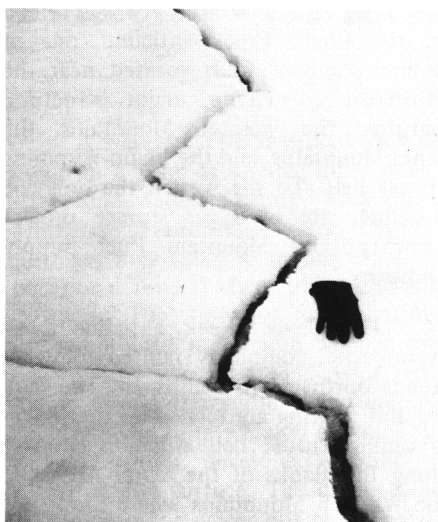
## ROCKY RIDGES



by Greg McLaughlin

## QUAKE

(continued from page 1)



Left: Polygonal crack pattern typical of ground cracking observed in Pocatello Valley. (UGMS photo) Right: Damage in farmhouse kitchen, epicentral region. North-south ground motion indicated here. (UGMS photo)



first to visit the epicentral region and to observe damage (see photos). The buckled storage bin (see photo) may prove to be the significant example of the quake's intensity.

Even with UGMS' four-wheel-drive vehicle, snow and soft ground would not allow for further exploration that day to the north in the Pocatello Valley. However, from the pattern of ground cracks observable in the snow cover and the extent of damage, Kaliser and Raja knew that the epicenter was near. On

April 1, Kaliser flew air reconnaissance over the area.

No human casualties were reported in the region of the epicenter. Fortunately, the farms in the area are not occupied during the winter and early spring.

Currently Kaliser is studying traces of ground cracks, ground collapse features, structural damage, and other earthquake-caused phenomena as far removed from the epicenter as Salt Lake City.

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*Address Correction Requested*

## LATEST STUDIES

(continued from page 2)

employment and income, assessed valuation, occupational taxes and mine assessments, and many other categories.

**Map 35, *Oil and Gas Fields and Pipelines of Utah***, by Howard R. Ritzma and Paul W. Burchell. The map is free when obtained from the UGMS Publication Sales Office. For mail orders, however, a \$.25 charge for handling is required.

**Map 36, *Energy Resources Map of Utah***, compiled from data assembled by the staff of the UGMS in cooperation with the State Advisory Council on Science and Technology, the U. S. Bureau of Land Management, and the U. S. Forest Service, is being printed. The map includes all areas of energy resources found in Utah: oil and gas, oil shale, coal, oil-impregnated rock, uranium, geothermal, and electricity transmission network systems. Price of the map is yet to be determined.

### UTAH GEOLOGICAL AND MINERAL SURVEY QUARTERLY REVIEW

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